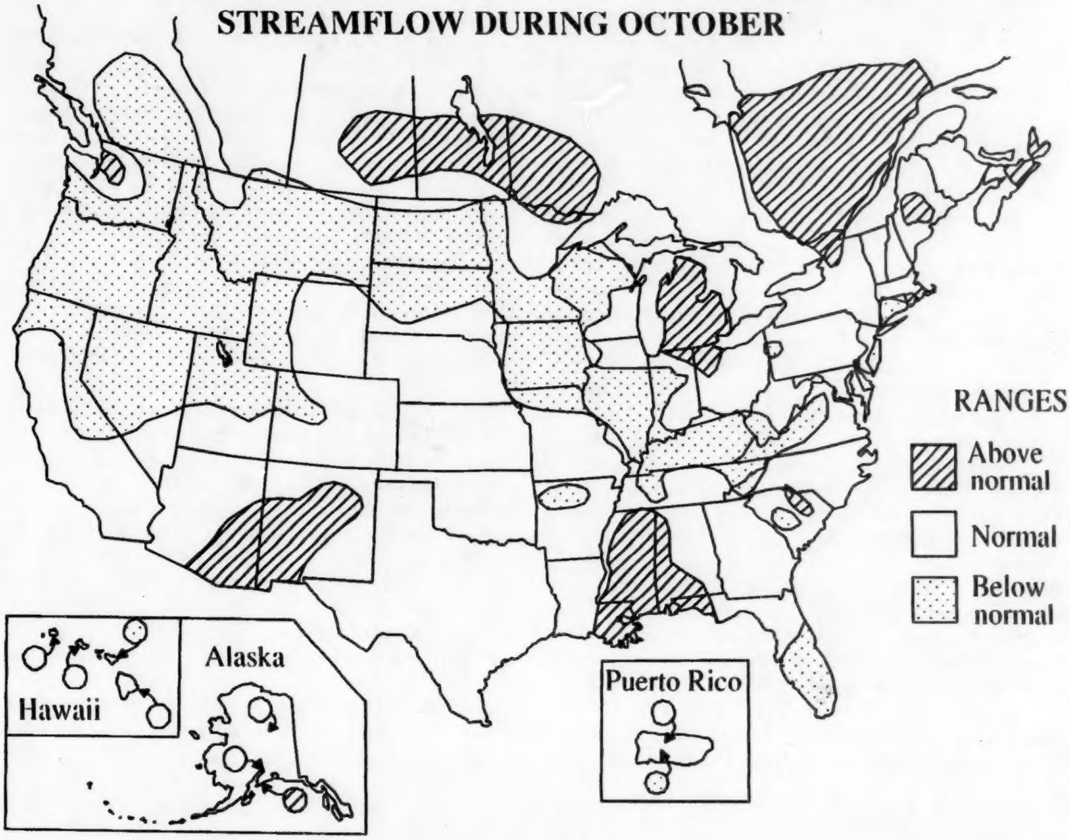
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

OCTOBER 1988

STREAMFLOW DURING OCTOBER



Streamflow was in the normal to above-normal range at 65 percent of the 191 reporting index stations in southern Canada, the United States, and Puerto Rico during October compared with 68 percent of 191 stations in those ranges during last month. Total October flow for the 181 reporting index stations in the conterminous United States and southern Canada was 15 percent below median and the lowest for October in the last 7 years. This was the eighth consecutive month of below-median total streamflow in southern Canada and the conterminous United States. Below-normal range streamflow occurred in 28 percent of the area of southern Canada and the conterminous United States during October compared with 27 percent during September. Only three monthly lows occurred during October compared with eight monthly lows during September.

The combined flow of the 3 largest rivers in the lower 48 States--Mississippi, St. Lawrence, and Columbia--was in the below-normal range and 22 percent below median during October after a 9 percent increase from September to October. Only the flow of the St. Lawrence River at Cornwall, Ontario, was in the normal range.

Monthend index reservoir contents for October 1988 were in the below-average range at 39 of 100 reporting sites, compared with 34 of 100 during September 1988. Only in Canada, South Carolina, Alabama, and Texas did most reservoirs have higher contents at the end of October 1988 than at the end of October 1987.

Mean October elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) declined from those for September at all four sites.

The elevation of Utah's Great Salt Lake declined 0.25 foot during the month and was 4,206.60 feet above National Geodetic Vertical Datum of 1929 on October 31.

SURFACE-WATER CONDITIONS DURING OCTOBER 1988

Minor flooding in the upper Snoqualmie River basin, unusual only in the occurrence of any floods at this time of year in the Pacific Northwest, was caused by a storm which stalled in the central Cascade Mountains east of Seattle, Washington, October 15-16. At least one jokulhlaup (glacial outburst flood) occurred on Tahoma Creek below Tahoma Glacier on Mt. Rainier, on October 16.

Streamflow was in the normal to above-normal range at 65 percent of the 191 reporting index stations in southern Canada, the United States, and Puerto Rico during October compared with 68 percent of 191 stations in those ranges during last month. This is the second lowest percentage of stations with flow in the normal to above-normal range for October in the last 7 years. About 66 percent of 190 stations had flow in the normal to above-normal range during October 1987. Total October flow of 994,400 cubic feet per second (cfs) for the 181 reporting index stations in the conterminous United States and southern Canada was 15 percent below median and the lowest for October in the last 7 years, after a 3 percent increase in streamflow from September to October. This was the eighth consecutive month of below-median total streamflow in southern Canada and the conterminous United States. Below-normal range streamflow occurred in 28 percent of the area of southern Canada and the conterminous United States during October compared with 27 percent during September, 39 percent during August, 50 percent during July, and 60 percent during June.

Three monthly lows occurred during October compared with eight monthly lows, including one all-time low, during September. The October monthly low of 1.56 cfs on the Sangamon River at Monticello, Illinois, was 94 percent below median, 47 percent below the previous October low (2.97 cfs in 1953), and the third consecutive monthly low at that station (78 years of record). The October daily low of no flow on the Sangamon River equaled the all-time daily low set last month. The October mean 775 cfs on the Yellowstone River at Corwin Springs, Montana , where the period of record is 82 years, was 48 percent below median and 12 percent below the previous October low (875 cfs in 1987). On the Yellowstone River at Billings, Montana, where the period of record is 61 years, the monthly mean of 2,131 cfs was 50 percent below median and 14 percent below the previous October low (2,483 cfs in 1935). Hydrographs for these three index stations, and also for the North Fork American River at North Fork Dam, California, where streamflow has been in the below-normal range for 9 consecutive months and the October mean is the second lowest of record (46 years), are shown on page 4.

Precipitation during October 1988 (maps on page 5) varied widely in the United States, ranging from none in some western areas to more than 200 percent of normal in southern Arizona and some parts of the East.

October streamflow was 3 percent (Southeast) to 25 percent (Pacific Northwest) below median in five areas (graphs on page 6) affected by the drought. Flow decreased from that for September in four of five areas, ranging from 29 percent in California to 14 percent in the Northern Great Plains. In the Western Great Lakes, streamflow increased from that for September by 28 percent, but was 23 percent below median. Graphs of actual streamflow in the five areas for each month of the 1988 and 1989 water years, and also 1951-80 median streamflow for each month are on page 7.

The combined flow of the 3 largest rivers in the lower 48 States--Mississippi, St. Lawrence, and Columbia--averaged a below-normal range 502,200 cfs (22 percent below median), during October after a 9 percent increase from September to October. Flows of both the Columbia River at The Dalles, Oregon, and the Mississippi River at Vicksburg, Mississippi, were in the below-normal range for the sixth consecutive month. October flow of the St. Lawrence River at Cornwall, Ontario, was in the normal range, had the highest individual flow of the three rivers during October, accounting for 48 percent of the combined flow, and was greater than the flow of the Mississippi River for the fifth consecutive month. Hydrographs for both the combined and individual flows of the "Big 3" are on page 8. Dissolved solids and water temperatures at five large river stations are also given on page 8. October flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 9.

Streamflow for the 45 large rivers ranged from 76 percent below median on the Red River of the North at Grand Forks,

(Continued on page 4.)

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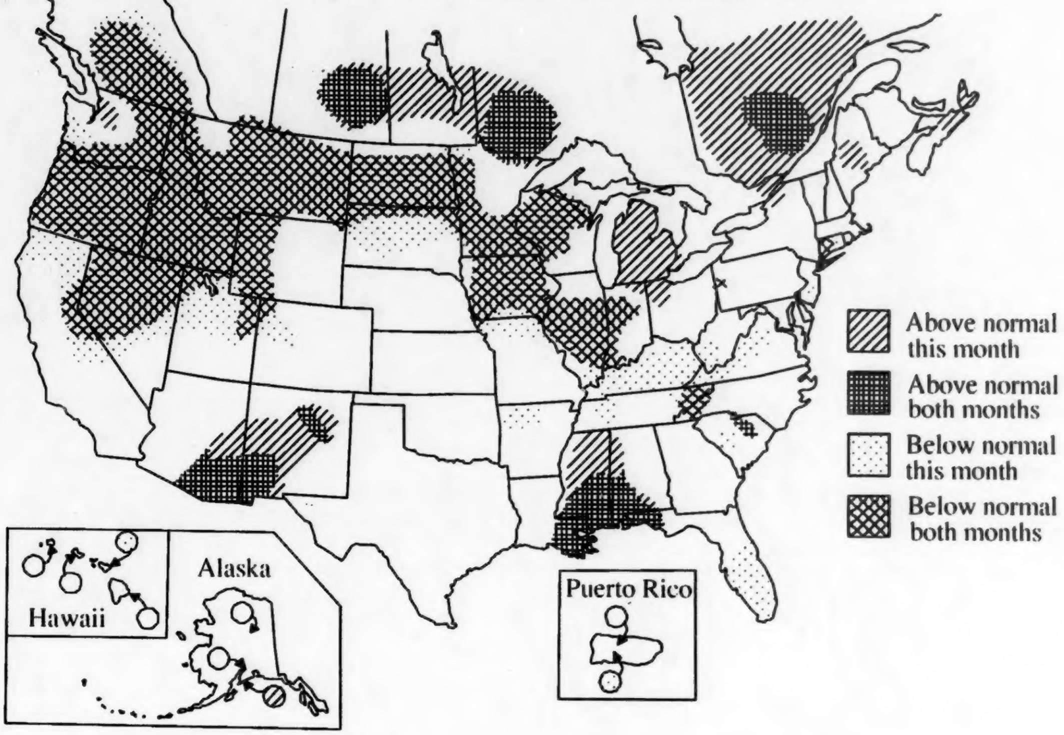
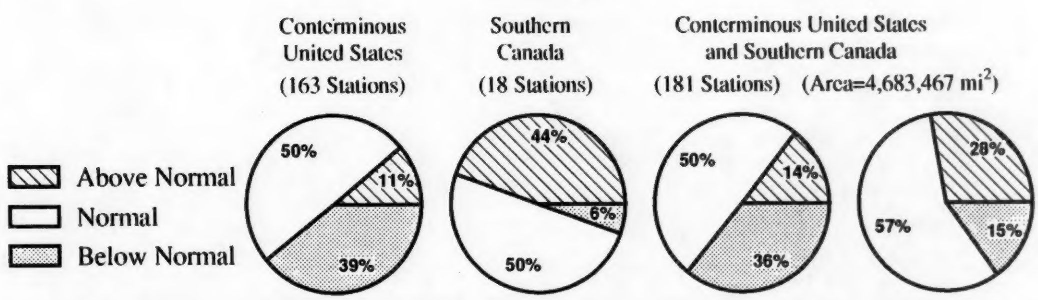
PERSISTENCE IN, OR MOVEMENT INTO, THE BELOW-NORMAL OR ABOVE-NORMAL FLOW RANGE: SEPTEMBER TO OCTOBER 1988

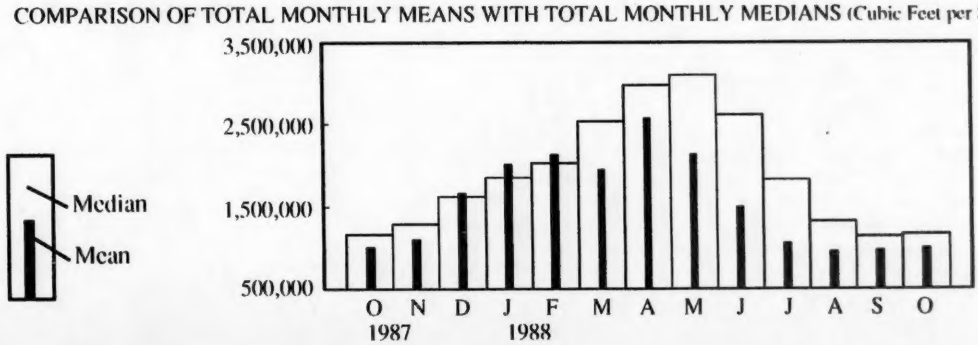


SUMMARY OF OCTOBER 1988 STREAMFLOW

FLOW RANGES

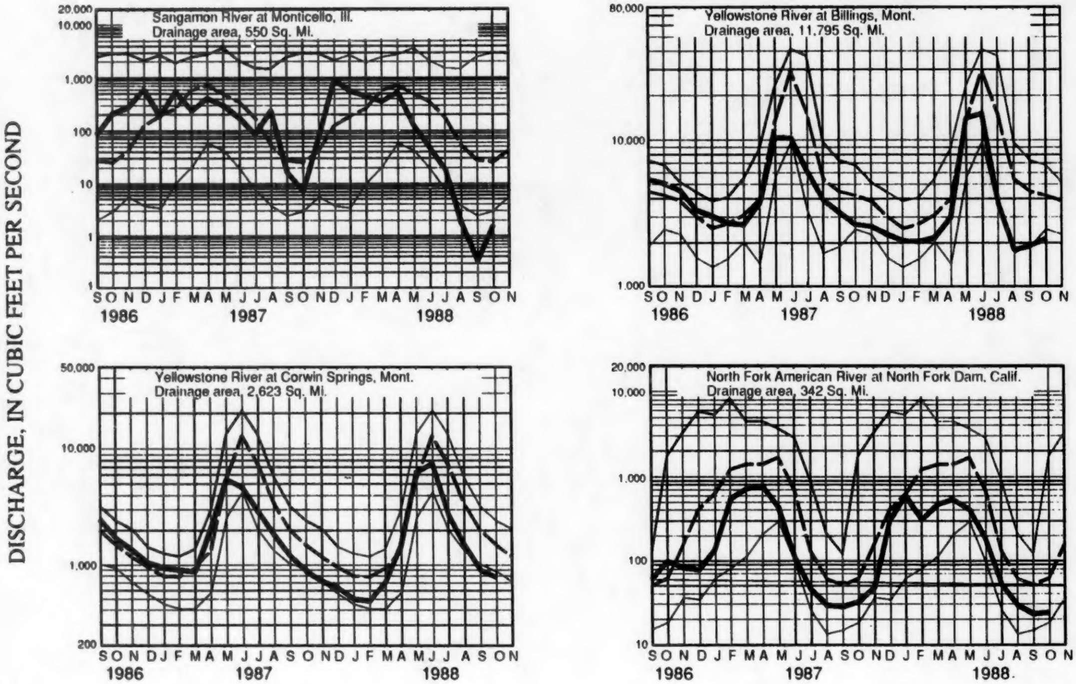


COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS (Cubic Feet per Second)



MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



(Continued from page 2.)

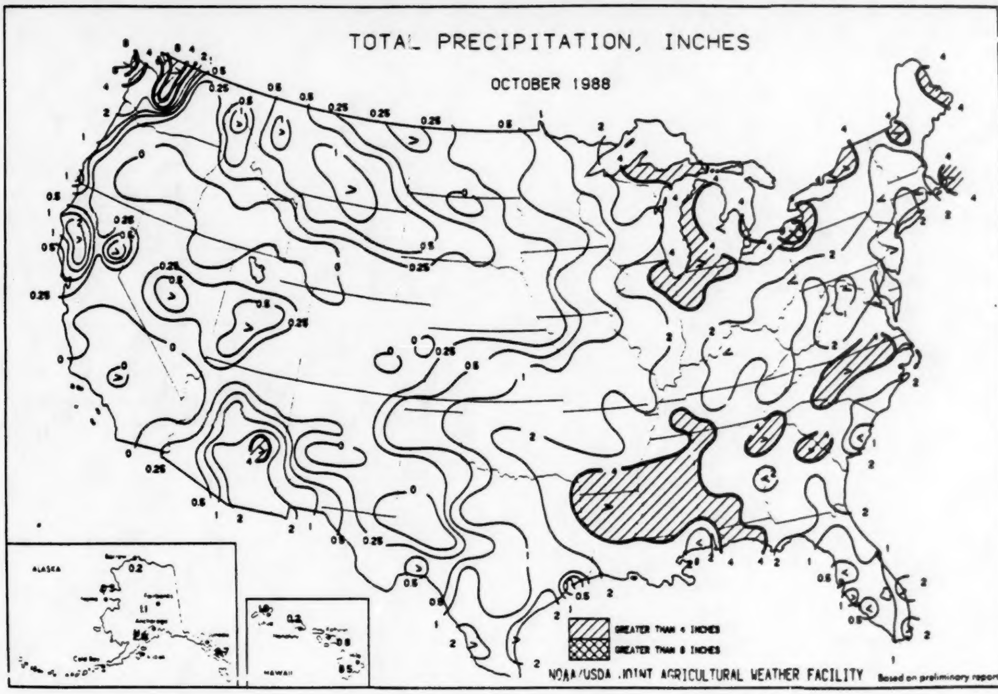
North Dakota, and the Minnesota River near Jordan, Minnesota, to 122 percent above median on the Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama. Flow increased from September to October at 21 of the 45 stations, compared with increases at 29 of the 45 stations from August to September. The largest increase (109 percent) brought flow of the Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin, into the normal range after a below-normal range September. Streamflow was below median at 34 of the 45 stations, compared with below-median flow at 27 of the 45 stations during September.

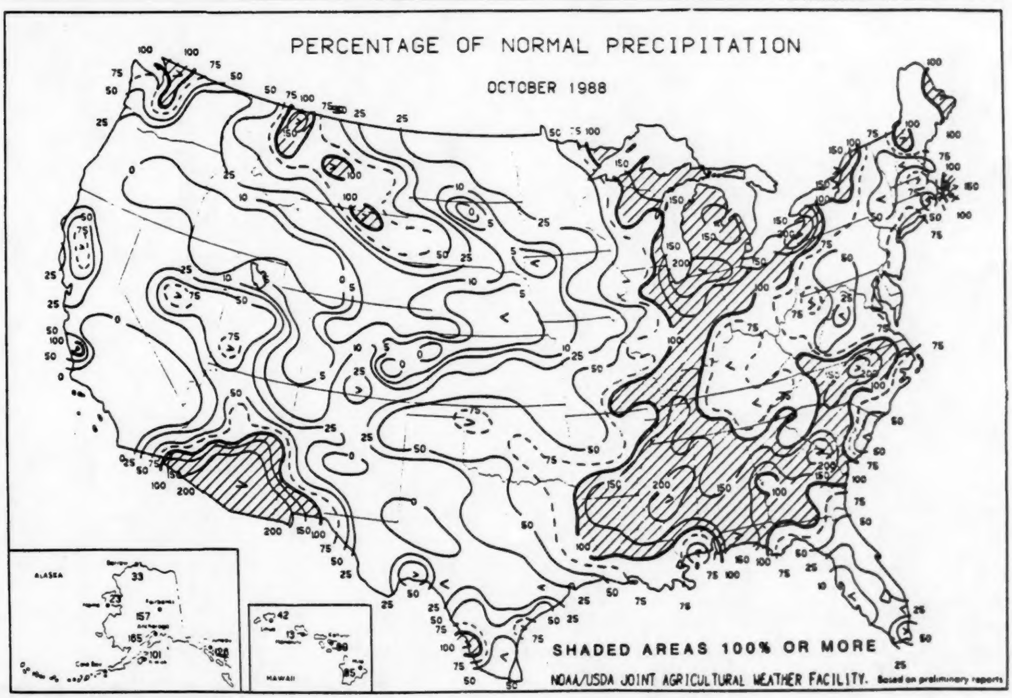
Monthend index reservoir contents for October 1988 were in the below-average range (below the monthend average for the period of record by more than 5 percent of normal maximum contents) at 39 of 100 reporting sites, compared with 34 of 100 during September 1988, including most reservoirs in New Jersey, the Dakotas, Montana, Wyoming, Idaho, Washington, California, and Nevada. Lake Tahoe, straddling California and Nevada, had no usable storage left at the end of the month. October 1988 contents were lower than those of October 1987 at 69 of the 100 sites. Only in Canada, South Carolina, Alabama, and Texas did most reservoirs have higher contents at the end of October 1988 than at the end of October 1987. In the Southeast, 3 of the 10 index reservoirs with capacities greater than 1,000,000 acre-feet had contents which were less than those of October 1986, the most recent year of drought in that area prior to 1988. Graphs of contents for seven reservoirs are shown on page 10 with contents for the 100 reporting reservoirs given on page 11.

Mean October elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) declined from those for September at all four sites. The monthly means were in the normal range on all the lakes except Superior, which was in the below-normal range for the sixth consecutive month. On Lake Ontario, the monthly mean in the normal range came after four consecutive months of below-normal mean elevations. October 1988 levels ranged from 0.14 foot higher (Lake Ontario) to 1.33 feet lower (Lake Huron) than those for October 1987. Stage hydrographs for the master gages on Lakes Superior, Huron, Erie, and Ontario are on page 14.

The elevation of Utah's Great Salt Lake (graph on page 14) declined 0.25 foot during the month and was 4,206.60 feet above National Geodetic Vertical Datum (NGVD) of 1929 on October 31. The total decline in lake level since the seasonal high of 4,209.55 feet above NGVD of 1929 during February is 2.95 feet. Lake level is 285 feet lower than at the end of October 1987 and 5.25 feet lower than the recorded all-time high of 4,211.85 feet above NGVD of 1929, which occurred during July 1986 and was equaled during April 1987.

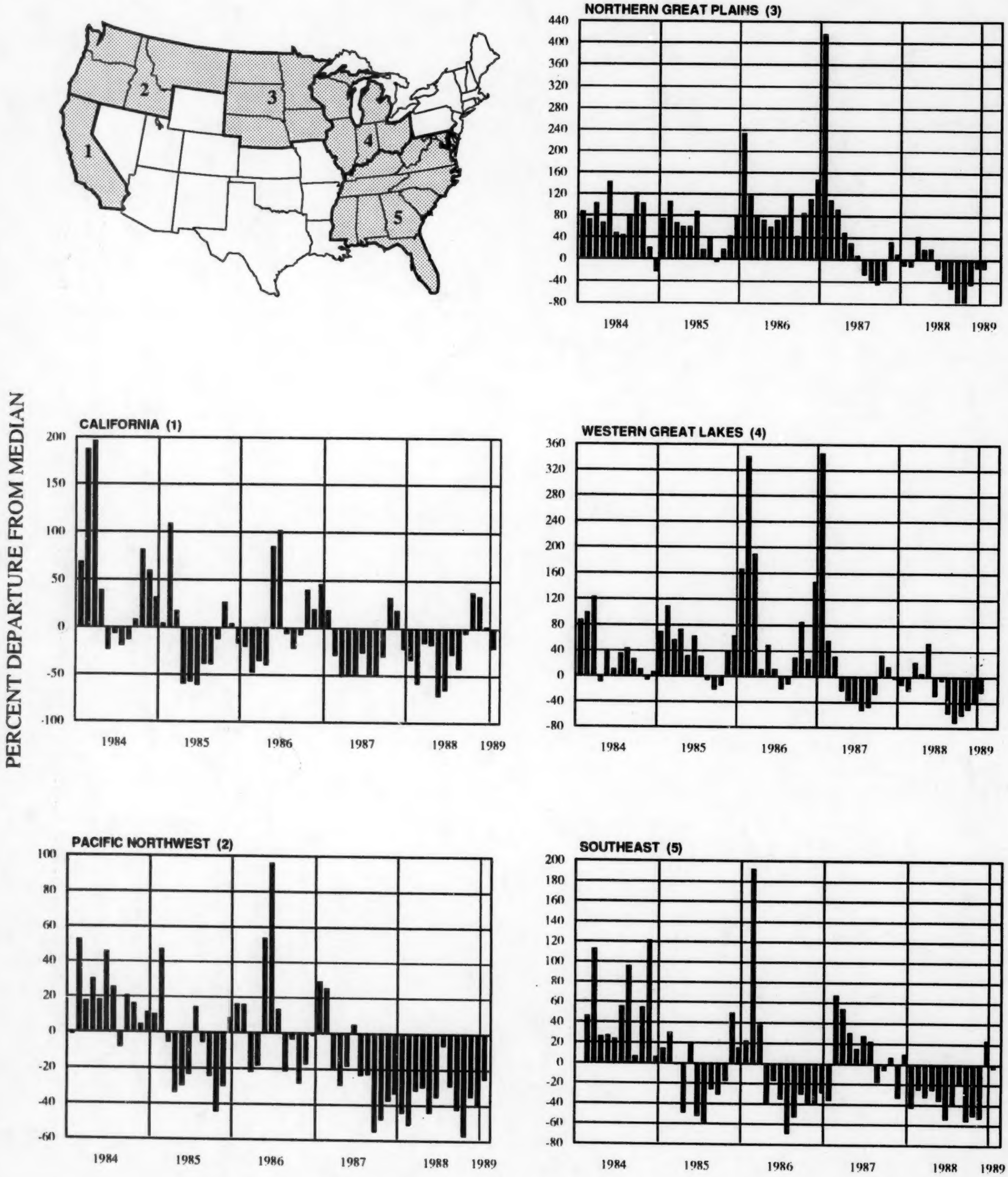
November 1988-January 1989 outlook maps for both temperature and precipitation are on page 15. Precipitation is likely to be above median only in a narrow coastal area extending from northern South Carolina to Massachusetts.



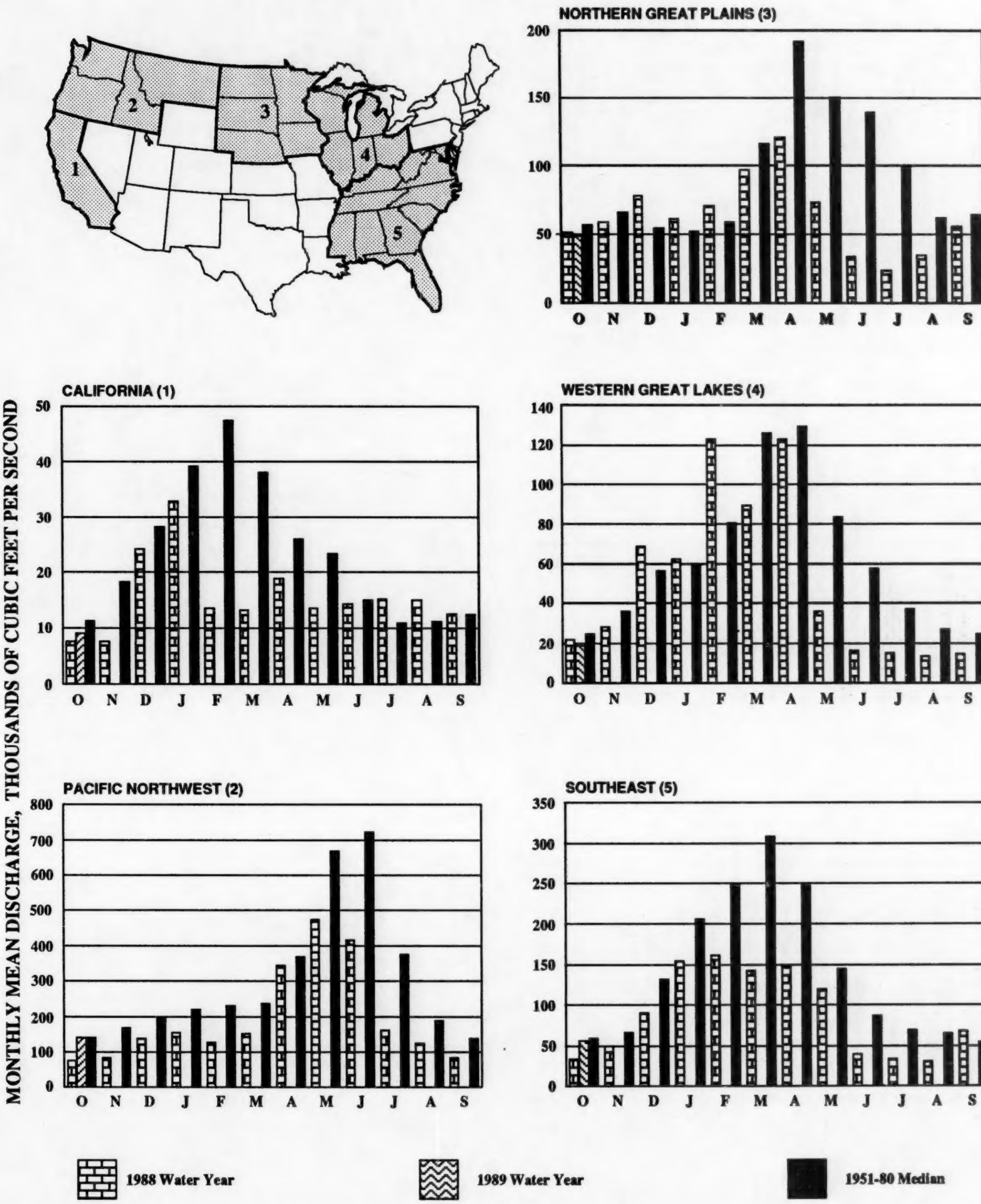


(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Weather Facility)

MONTHLY DEPARTURE OF ACTUAL STREAMFLOW (OCTOBER 1983-OCTOBER 1988) FROM MEDIAN STREAMFLOW (1951-80)

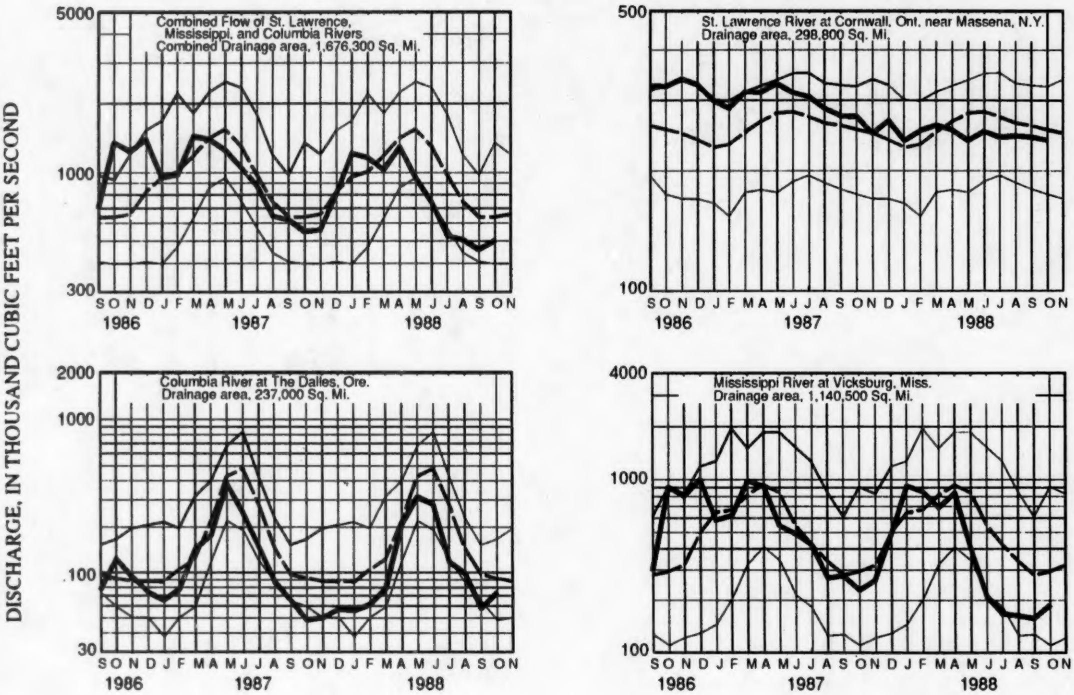


ACTUAL MONTHLY STREAMFLOW, 1988 AND 1989 WATER YEARS, COMPARED WITH MEDIAN MONTHLY STREAMFLOW, 1951-80



HYDROGRAPHS FOR THE "BIG THREE" RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR OCTOBER 1988, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	October data of following calendar years	Stream discharge during month Mean (cfs)	Dissolved-solids concentration[a] Minimum (mg/L)	Dissolved-solids concentration[a] Maximum (mg/L)	Dissolved-solids discharge[a] Mean (tons per day)	Dissolved-solids discharge[a] Minimum (tons per day)	Dissolved-solids discharge[a] Maximum (tons per day)	Water temperature[b] Mean in °C	Water temperature[b] Minimum in °C	Water temperature[b] Maximum in °C
01463500	Delaware River at Trenton, N.J.	1988	3,770	108	134	1,246	977	1,884	13.0	8.0	19.5
	(Morrisville, Pa.)	1944-87	6,648	58	156	----	463	8,300	---	8.5	25.5
		(Extreme yr)		(1945)	(1953)		(1963)	(1955)			
			[c]4,918								
07289000	Mississippi River at Vicksburg, Miss.	1988	189,300	269	311	146,600	129,400	169,500	18.0	16.0	24.0
		1975-87	394,200	183	337	282,100	117,000	639,700	20.0	15.0	26.0
		(Extreme yr)		(1979,	(1983,		(1976)	(1986)			
			[c]295,000	1982)	1987)						
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill. (streamflow station at Metropolis, Ill.)	1988	59,500	166	211	----	21,500	48,700	---	19.5	23.5
		1954-87	115,900	135	330	----	11,900	262,000	---	12.0	26.0
		(Extreme yr)		(d)	(1967)		(1985)	(1976)			
			[c]96,680								
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1988	46,500	442	493	59,900	56,000	69,400	19.0	11.5	19.5
		1975-87	87,560	168	558	88,570	51,800	272,000	16.0	10.0	22.5
		(Extreme yr)		(1986)	(1980)		(1976)	(1986)			
			[c]60,140								
14128910	Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.)	1988	108,000	92	95	27,300	21,200	38,500	17.0	15.0	18.0
		1975-87	118,100	73	117	31,700	13,200	49,200	15.5	11.0	19.5
		(Extreme yr)		(1981)	(1977)		(1981)	(1987)			
			[c]91,570								

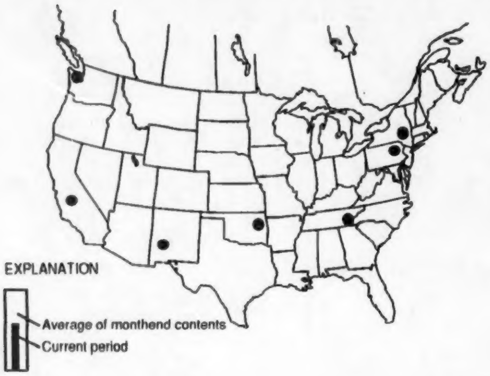
[a]Dissolved-solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.
[d]Occurred several years.

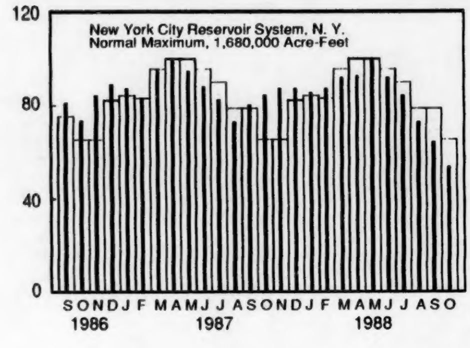
FLOW OF LARGE RIVERS DURING OCTOBER 1988

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1980 (cubic feet per second)	October 1988: Monthly mean discharge (cubic feet per second)	October 1988: Percent of median monthly discharge 1951-80	October 1988: Change in discharge from previous month (percent)	October 1988: Discharge near end of month: Cubic feet per second	October 1988: Discharge near end of month: Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,690	9,647	6,558	136	+108	8,990	5,810	31
01318500	Hudson River at Hadley, N.Y.	1,664	2,909	1,400	100	+33	2,230	1,441	31
01357500	Mohawk River at Cohoes, N.Y.	3,456	5,734	2,370	92	+42	3,000	1,900	31
01463500	Delaware River at Trenton, N.J.	6,780	11,750	3,771	77	−30	....	....	..
01570500	Susquehanna River at Harrisburg, Pa.	24,100	34,530	5,706	53	−50	8,730	5,642	26
01646500	Potomac River near Washington, D.C.	11,560	[1]11,490	[1]2,090	73	−25	2,010	1,299	31
02105500	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	5,005	1,940	97	−5	....	....	..
02131000	Pee Dee River at Peedee, S.C.	8,830	9,851	5,420	117	−1	3,690	2,384	31
02226000	Altamaha River at Doctortown, Ga.	13,600	13,880	4,078	79	−19	2,580	1,667	30
02320500	Suwannee River at Branford, Fla.	7,880	6,987	4,780	104	−21	3,860	2,490	31
02358000	Apalachicola River at Chattahoochee, Fla.	17,200	22,570	10,800	99	+22	....	....	..
02467000	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	23,300	10,350	264	+53	4,950	3,199	31
02489500	Pearl River near Bogalusa, La.	6,630	9,768	4,706	222	+13	2,670	1,725	31
03049500	Allegheny River at Natrona, Pa.	11,410	[1]19,480	[1]6,650	95	+38	10,400	6,720	25
03085000	Monongahela River at Braddock, Pa.	7,337	[1]12,510	[1]3,610	93	−19	8,630	5,577	25
03193000	Kanawha River at Kanawha Falls, W.Va.	8,367	12,590	2,442	40	−25	2,320	1,499	29
03234500	Scioto River at Higby, Ohio	5,131	4,547	658	86	−54	549	354	31
03294500	Ohio River at Louisville, Ky.[2]	91,170	11,600	29,700	83	−26	23,660	15,290	30
03377500	Wabash River at Mount Carmel, Ill.	28,635	27,220	4,034	58	+31	6,020	3,890	25
03469000	French Broad River below Douglas Dam, Tenn.	4,543	6,798	1,667	44	−3	....	....	..
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,163	2,812	126	+109	2,289	1,479	31
04264331	St. Lawrence River at Cornwall, Ontario - near Massena, N.Y.[3]	298,800	242,700	239,000	94	−2	240,000	155,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	25,150	35,400	186	+44	27,600	17,840	31
05082500	Red River of the North at Grand Forks, N.Dak.	30,100	2,551	327	24	−15	390	252	28
05133500	Rainy River at Manitou Rapids, Minn.	19,400	11,830	20,300	187	−34	12,700	8,210	26
05330000	Minnesota River near Jordan, Minn.	16,200	3,402	251	24	0	248	160	31
05331000	Mississippi River at St. Paul, Minn.	36,800	[1]10,610	4,121	63	+37	3,400	2,200	31
05365500	Chippewa River at Chippewa Falls, Wis.	5,600	5,100	1,305	47	−17	1,925	1,244	31
05407000	Wisconsin River at Muscoda, Wis.	10,300	8,617	3,720	68	+4	4,063	2,625	31
05446500	Rock River near Joslin, Ill.	9,551	5,873	2,240	68	+27	2,400	1,550	31
05474500	Mississippi River at Keokuk, Iowa	119,000	62,620	22,580	64	+6	23,300	15,060	31
06214500	Yellowstone River at Billings, Mont.	11,796	7,038	2,131	51	+12	2,440	1,577	31
06934500	Missouri River at Hermann, Mo.	524,200	79,490	46,520	77	+5	45,000	29,100	31
07289000	Mississippi River at Vicksburg, Miss.[4]	1,140,500	576,600	189,300	64	+20	175,000	113,100	28
07331000	Washita River near Dickson, Okla.	7,202	1,368	520	100	−63	450	290	31
08276500	Rio Grande below Taos Junction Bridge, near Taos, N.Mex.	9,730	725	309	112	+5	320	206	31
09315000	Green River at Green River, Utah	44,850	6,298	1,903	66	+14	1,750	1,131	31
11425500	Sacramento River at Verona, Calif.	21,257	18,820	8,786	83	−29	....	....	..
13269000	Snake River at Weiser, Idaho	69,200	18,050	10,400	71	+10	11,200	7,240	31
13317000	Salmon River at White Bird, Idaho	13,550	11,250	3,100	62	+22	3,090	1,997	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,480	2,440	65	+47	2,050	1,324	31
14105700	Columbia River at The Dalles, Oreg.[5]	237,000	[1]193,100	[1]73,880	81	+27	113,200	73,160	26
14191000	Willamette River at Salem, Oreg.	7,280	[1]23,510	[1]2,886	43	+13	12,560	8,117	27
15515500	Tanana River at Nenana, Alaska	25,600	23,460	14,320	92	−50	11,000	7,100	31
08MF005	Fraser River at Hope, British Columbia.	83,800	96,290	54,020	74	−20	51,550	33,320	31

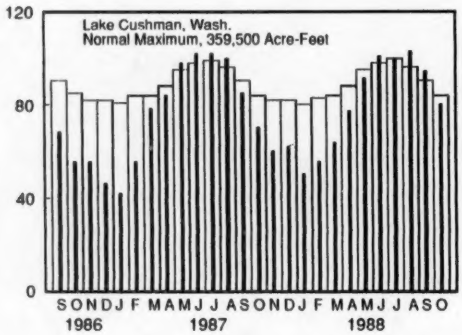
[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.
[4]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

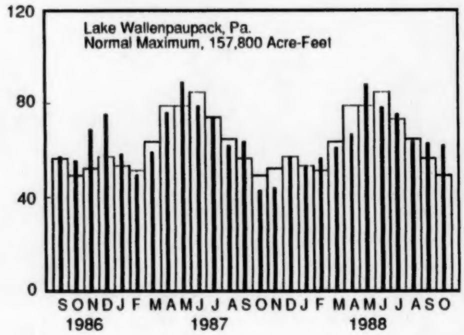
USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS

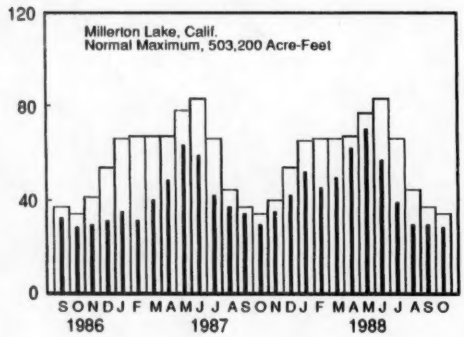


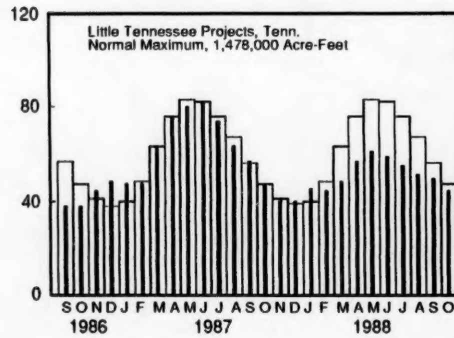


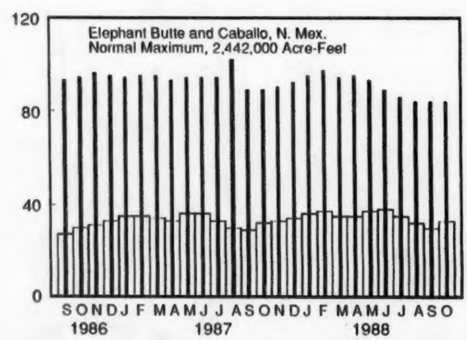
PERCENT OF NORMAL MAXIMUM

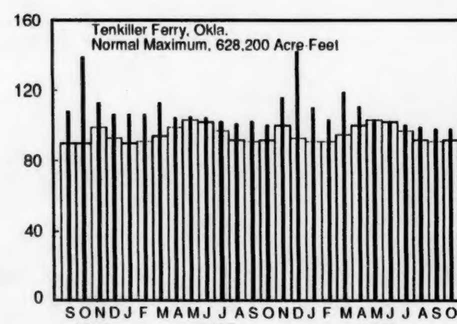












Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF OCTOBER 1988

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F--Flood control I--Irrigation M--Municipal P--Power R--Recreation W--Industrial	Percent of normal maximum				Normal maximum (acre-feet)[a]
	End of Oct. 1988	End of Oct. 1987	Average for end of Oct.	End of Sep. 1988	
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	41	34	35	44	[b]226,300
QUEBEC					
Allard (P)	75	42	59	82	280,600
Gouin (P)	59	49	68	52	6,954,000
MAINE					
Seven reservoir systems (MP)	57	51	52	60	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)	72	73	73	85	76,450
Lake Francis (FPR)	82	78	76	78	99,310
Lake Winnipesaukee (PR)	61	75	57	70	165,700
VERMONT					
Harriman (P)	69	77	62	70	116,200
Somerset (P)	75	90	69	71	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	68	78	71	72	77,920
NEW YORK					
Great Sacandaga Lake (FPR)	60	97	55	62	786,700
Indian Lake (FMP)	76	43	56	83	103,300
New York City reservoir system(MW)	54	84	65	64	1,680,000
NEW JERSEY					
Wanaque (M)	57	76	64	53	77,450
PENNSYLVANIA					
Allegheny (FPR)	35	44	34	36	1,180,000
Pymatuning (FMR)	89	97	79	88	188,000
Raystown Lake (FR)	66	67	57	67	761,900
Lake Wallenpaupack (PR)	62	43	49	63	157,800
MARYLAND					
Baltimore municipal system (M)	75	81	83	82	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P)	91	91	82	91	288,800
Narrows (Badin Lake) (P)	93	85	94	95	128,900
High Rock Lake (P)	49	72	58	66	234,800
SOUTH CAROLINA					
Lake Murray (P)	84	77	64	89	1,614,000
Lakes Marion and Moultrie (P)	83	73	67	83	1,862,000
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	25	43	54	27	1,730,000
GEORGIA					
Burton (PR)	98	95	70	98	104,000
Sinclair (MPR)	88	87	77	88	214,000
Lake Sidney Lanier (FMPR)	37	41	51	37	1,686,000
ALABAMA					
Lake Martin (P)	88	81	68	94	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	30	28	32	33	2,293,000
Douglas Lake (FPR)	20	16	23	28	1,394,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	50	55	49	52	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	38	40	40	41	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	44	46	47	49	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)	77	82	79	75	365,000
Wisconsin River (21 reservoirs) (PR)	48	49	66	52	399,000
MINNESOTA					
Mississippi River headwater system (FMR)	35	37	29	38	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	65	83	89	66	22,700,000
SOUTH DAKOTA					
Angostura (I)	43	67	70	43	130,768
Belle Fourche (I)	18	57	36	16	185,200
Lake Francis Case (FIP)	54	61	61	73	4,589,000
Lake Oahe (FIP)	64	82	---	67	22,240,000
Lake Sharpe (FIP)	103	100	98	100	1,697,000
Lewis and Clark Lake (FIP)	98	90	105	102	432,000

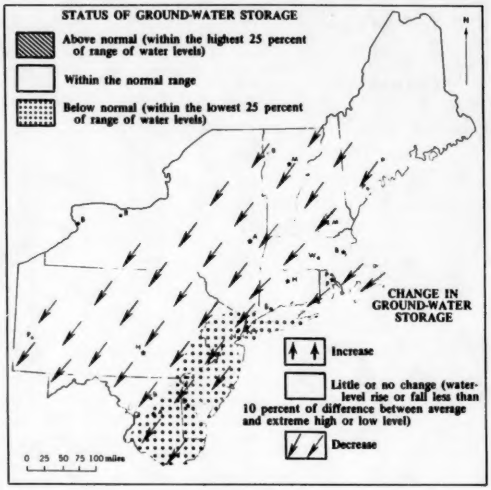
Reservoir Principal uses: F--Flood control I--Irrigation M--Municipal P--Power R--Recreation W--Industrial	Percent of normal maximum				Normal maximum (acre-feet)[a]
	End of Oct. 1988	End of Oct. 1987	Average for end of Oct.	End of Sep. 1988	
NEBRASKA					
Lake McConaughy (IP)	69	75	69	66	1,948,000
OKLAHOMA					
Eufaula (FRP)	91	93	88	90	2,378,000
Keystone (FPR)	78	79	88	82	661,000
Tenkiller Ferry (FPR)	98	100	92	98	628,200
Lake Altus (FIMR)	64	84	48	63	133,000
Lake O'The Cherokees (FPR)	86	85	83	93	1,492,000
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	91	89	93	92	2,722,000
TEXAS					
Bridgeport (IMW)	63	85	49	67	386,400
Canyon (FMR)	98	83	77	99	385,600
International Amistad (FIMPW)	102	98	85	102	3,497,000
International Falcon (FIMPW)	106	102	75	97	2,668,000
Livingston (IMW)	76	95	86	77	1,788,000
Possum Kingdom (IMPRW)	73	65	98	73	570,200
Red Bluff (PI)	57	70	28	58	307,000
Toledo Bend (P)	78	75	79	80	4,472,000
Twin Buttes (FIM)	71	77	31	72	177,800
Lake Kemp (IMW)	66	88	86	66	268,000
Lake Meredith (FWM)	42	37	38	43	796,900
Lake Travis (FIMPRW)	82	84	80	80	1,144,000
MONTANA					
Canyon Ferry (FIMPR)	69	77	88	69	2,043,000
Fort Peck (FPR)	72	83	86	72	18,910,000
Hungry Horse (FIPR)	49	67	87	49	3,451,000
WASHINGTON					
Ross (PR)	79	79	86	86	1,052,000
Franklin D. Roosevelt Lake (IP)	92	93	102	91	5,022,000
Lake Chelan (PR)	84	74	74	90	676,100
Lake Cushman (PR)	80	70	84	94	359,500
Lake Merwin (P)	64	100	87	103	245,600
IDAHO					
Boise River (4 reservoirs) (FIP)	22	20	48	20	1,235,000
Coeur d'Alene Lake (P)	63	57	54	81	238,500
Pend Oreille Lake (FP)	45	28	68	83	1,561,000
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	16	23	51	10	4,401,000
WYOMING					
Boysen (FIP)	57	88	83	57	802,000
Buffalo Bill (IP)	33	43	73	32	421,300
Keyhole (F)	27	40	42	28	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs(I)	51	56	47	51	3,056,000
COLORADO					
John Martin (FIR)	22	68	15	23	364,400
Taylor Park (IR)	72	73	55	76	106,200
Colorado-Big Thompson project (I)	66	69	56	69	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	86	89	---	87	31,620,000
UTAH--IDAHO					
Bear Lake (IPR)	56	69	60	57	1,421,000
CALIFORNIA					
Folsom (FIP)	18	32	54	22	1,000,000
Hetch Hetchy (MP)	60	57	50	66	360,400
Isabella (FIR)	13	25	27	13	568,100
Pine Flat (FI)	7	14	39	6	1,001,000
Clair Engle Lake (Lewiston) (P)	54	66	70	62	2,438,000
Lake Almanor (P)	68	87	52	73	1,036,000
Lake Berryessa (FIMW)	62	62	74	62	1,600,000
Millerton Lake (FI)	28	29	34	29	503,200
Shasta Lake (FIPR)	37	50	64	36	4,377,000
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	0	37	49	2	744,600
NEVADA					
Rye Patch (I)	4	31	56	5	194,300
ARIZONA--NEVADA					
Lake Mead and Lake Mohave(FIMP)	87	92	72	87	27,970,000
ARIZONA					
San Carlos (IP)	45	53	21	43	935,100
Salt and Verde River system(IMPR)	80	60	39	81	2,019,100
NEW MEXICO					
Conchas (FIR)	81	92	80	84	315,700
Elephant Butte and Caballo (FIPR)	84	89	33	84	2,442,000

[a]1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second day.
[b]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

GROUND-WATER CONDITIONS DURING OCTOBER 1988

Ground-water levels declined seasonally in most of the Northeast. (See map.) There was a mixed pattern of rising and falling levels in northern and eastern Maine, in much of Connecticut and Rhode Island, and in northern and western New York State. Below-average water-level conditions persisted in Delaware, eastern Maryland, much of New Jersey, and on Long Island, New York. Elsewhere in the region, water levels near the end of October were in the normal range of levels for this time of year in most of the key observation wells.

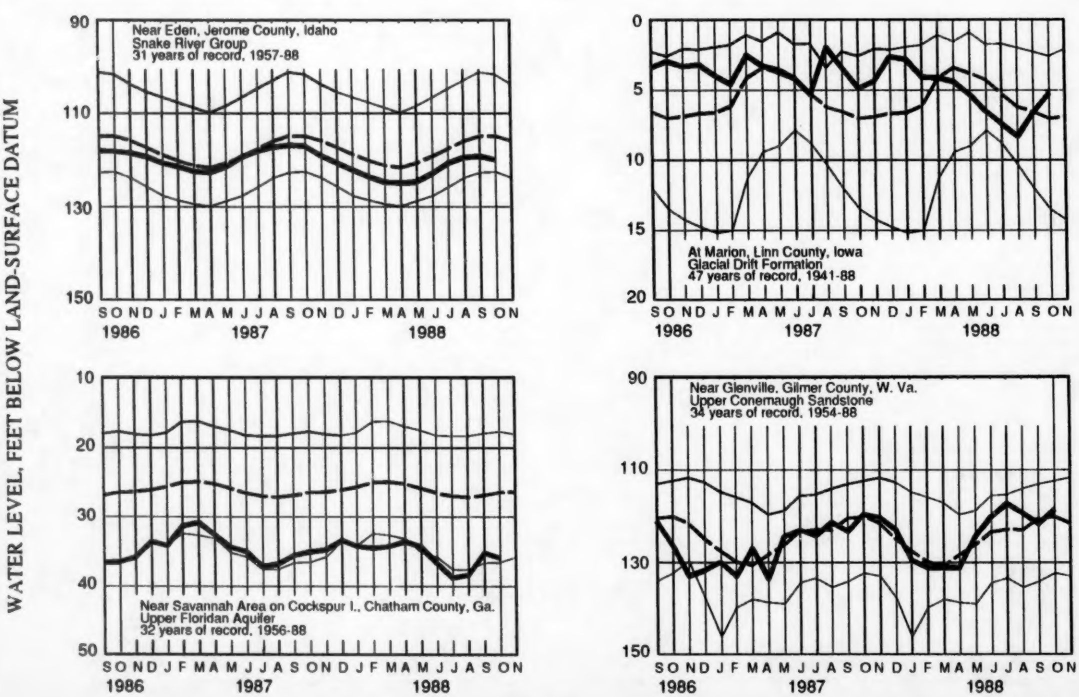
In the Southeastern States, ground-water levels declined during October in West Virginia, Kentucky, Virginia, and Florida. Net changes in levels were mixed in North Carolina, Arkansas, Louisiana, Mississippi, and Georgia. Water levels were above long-term averages in Kentucky, and below average in Arkansas, Louisiana, and Florida. Levels were mixed with respect to average in West Virginia, Virginia, North Carolina, and Georgia. New low water levels for October were recorded in the key well in Memphis, in western Tennessee, and in the key well in Montgomery, Alabama, despite a net rise during the month in the former and no net change in the latter. The level in the Cockspur Island well in the Coastal Plain of Georgia declined to a new October low. Levels in the Fairfax County key well in Virginia, and the observation well at Ruston, in Louisiana, declined to new all-time lows (31 and 13 years of record, respectively).



Map showing ground-water storage near end of October and change in ground-water storage from end of September to end of October.

MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.



In the central and western Great Lakes States, ground-water levels rose in Michigan. Net changes in levels were mixed in Minnesota, Ohio, and Iowa. Levels were above long-term averages in Michigan, mixed with respect to average in Iowa, and mostly below average in Minnesota and Ohio. In Minnesota, several new October low levels were reported in the deeper aquifer in the Minneapolis-St. Paul area.

In the Western States, ground-water levels rose in Washington and Nebraska, and declined in North Dakota, southern California, and Texas. Mixed water-level changes occurred in Idaho, Utah, Kansas, Arizona, and New Mexico. Water levels were below long-term averages in Washington, Idaho, North Dakota, southern California, Kansas, Arizona, and Texas. Water levels were mixed with respect to average in Nebraska, Utah, and New Mexico. New high water levels for October were recorded in Nevada, in the Steptoe Valley observation well, in the Blanding area well in Utah, and in the Berrendo-Smith key well in New Mexico. New October lows occurred in Idaho in the Boise Valley well, in the Dickinson well in North Dakota, and in the key well in El Paso in western Texas. A new October low also was recorded, despite a net rise of less than half a foot during the month, in the key well at the Kansas Agricultural Experiment Station in Colby, Kansas. A new all-time low level occurred in the key well in Wyndmere, North Dakota (25 years of record).

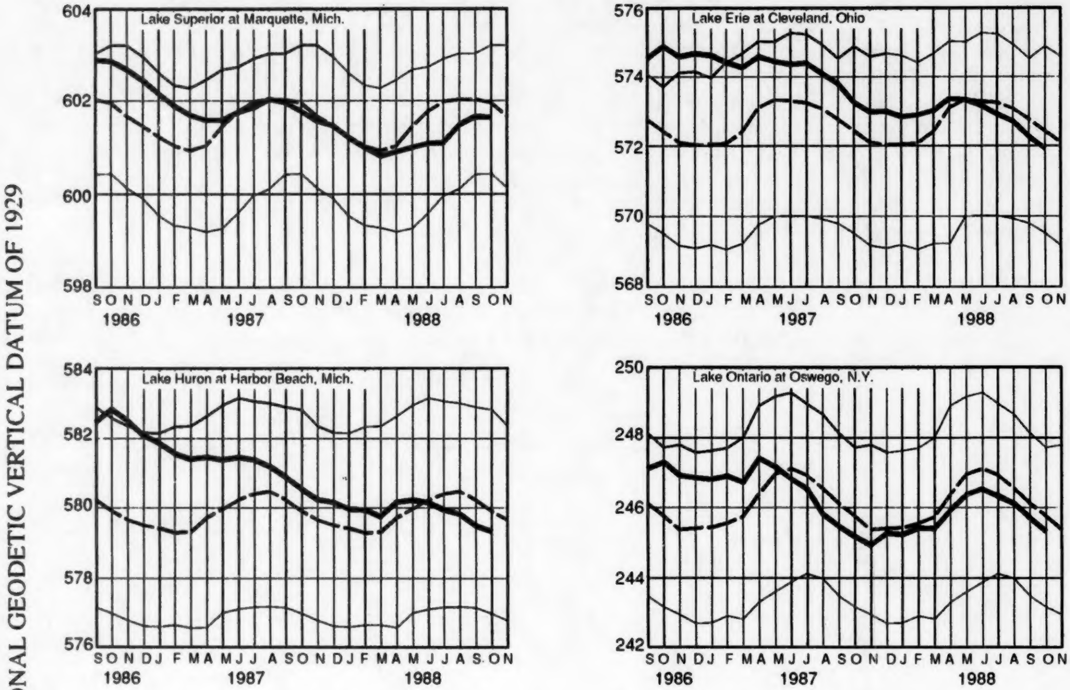
Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES--OCTOBER 1988

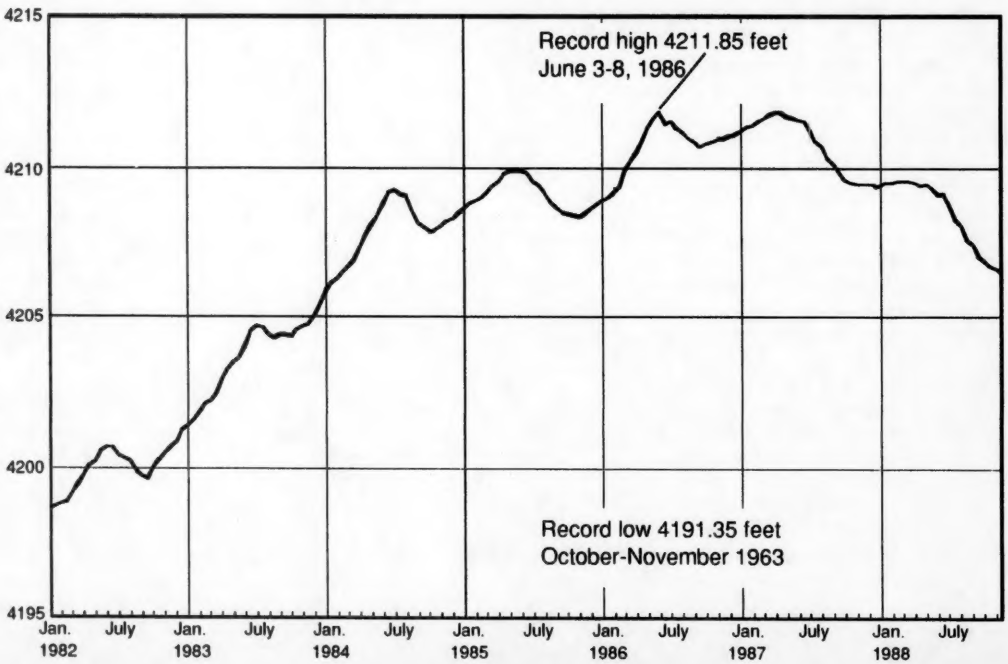
Aquifer and Location	Water level in feet with reference to land-surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Last year	Year records began	Remarks
Glacial drift at Hanska, south-central Minnesota	-12.25	-3.70	-1.60	+0.54	1942	
Glacial drift at Roscommon in north-central part of Lower Peninsula, Michigan.	-4.91	+0.04	+0.25	+0.45	1935	
Glacial drift at Marion, Iowa	-5.23	+1.44	+1.36	-0.35	1941	
Glacial drift at Princeton in northwestern Illinois	-10.02	+4.49	+2.00	-2.32	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	-17.04	-0.90	-0.29	-0.36	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	-20.51	+4.43	-0.15	-1.26	1946	
500-foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	-107.81	-17.44	+0.17	-0.83	1941	Oct. low.
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	-18.24	+2.50	+0.08	+1.17	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas	-240.90	-33.20	-0.70	-6.40	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	-30.1	-6.8	0.0	-0.8	1952	Oct. low.
Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	-35.97	-8.27	-0.69	-0.87	1956	Oct. low.
Sand and gravel in Puget Trough, Tacoma, Washington.	-107.08	-1.08	+10.50	-2.15	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	-467.4	-7.8	+0.3	-3.0	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	-119.9	-4.7	-0.8	-3.0	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	-22.40	+9.16	-5.10	-4.27	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	-8.42	-2.05	+0.07	-4.27	1935	
Alluvial valley fill in Steptoe Valley, Nevada	-7.67	----	+0.51	+0.19	1950	Oct. high.
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	-23.37	-2.88	-0.09	-3.71	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California.	-139.0	-1.64	-7.42	-12.31	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	-100.92	-18.89	+0.01	+2.38	1951	
Hueco bolson, El Paso area, Texas	-271.35	-21.92	-0.31	-4.52	1965	Oct. low.
Evangeline aquifer, Houston area, Texas	-308.15	-1.62	-2.65	+3.35	1965	

GREAT LAKES ELEVATIONS

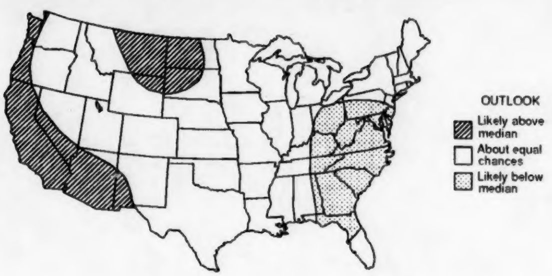
Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.



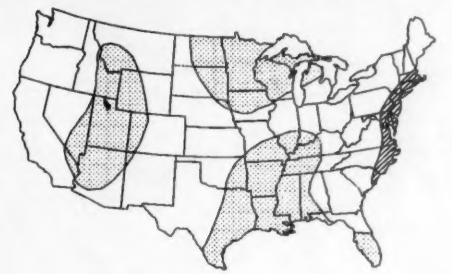
Fluctuations of Great Salt Lake, January 1982 through October 1988



TEMPERATURE OUTLOOK FOR NOVEMBER 1988 THROUGH JANUARY 1989



PRECIPITATION OUTLOOK FOR NOVEMBER 1988 THROUGH JANUARY 1989



NATIONAL WATER CONDITIONS

OCTOBER 1988

Based on reports from the Canadian and U.S. Field offices; completed December 1, 1988

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EXPLANATION OF DATA (Revised January 1988)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 183 index gaging stations--18 in Canada, 163 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, one New York index station, and the Puerto Rico index stations because of the limited records available.

The *persistence/change map* shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. The pie charts show percent of stations reporting discharges in each flow range for the conterminous United States, southern Canada, the two areas combined, and also the percent of area in each flow range for the conterminous United States and southern Canada. The bar graph shows total mean and total median flow for all reporting stations in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude--the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest 25 percent of flows and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: *above normal* if it is greater than the upper quartile, *in the normal range* if it is between the upper and lower quartiles, and *below normal* if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as *seasonal* if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as *contraseasonal* (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. *Probability of occurrence* is the chance that a given flood magnitude will be exceeded in any one year. *Recurrence interval* is the reciprocal of probability of occurrence and is the *average* number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. *Recurrence intervals imply no regularity of occurrence*; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about *ground-water levels* refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. *Changes in ground water levels*, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data for October are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). *Dissolved solids* are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. *Dissolved-solids discharge* represents the total daily amount of dissolved minerals carried by the stream. *Dissolved-solids concentrations* are generally higher during periods of low streamflow, but the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

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